Adapting to change: developmental, clinical and ecological perspectives on learning-based cognitive control

Tuesday, September 24, 2024 2:30 PM (1 hour)

Cognitive control (CC) is a crucial tool for adaptation in daily life (Diamond, 2020; Moffitt et al., 2011). While traditionally viewed as a top-down mechanism (Diamond, 2020; Miyake & Friedman, 2012), recent evidence shows that implicit learning shapes CC in a bottom-up manner, optimizing cognitive resources based on environmental changes (Abrahamse et al., 2016; Braem & Egner, 2018). This aligns with the Dual Mechanism Model (DMC) (Braver, 2012), suggesting that individuals adopt reactive or proactive control strategies depending on implicit situational demands. Despite its importance, few studies have explored learning-based CC development. Existing findings suggest that it stabilizes early in typical development and may be atypical in neurodevelopmental conditions such as ADHD (Gonthier et al., 2021; Cai et al., 2018).

In this presentation, using a neuro-constructivist framework (Karmiloff-Smith, 1992), I investigate learning-based CC from a clinical, developmental, and ecological perspective. Study 1 examines typically developing children (N=149, 5-14 years) using a Flanker task and cued-goNogo. Results show stable CC development in the Flanker task, while the cued-goNogo –which entails greater cognitive load –reveals optimal learning-based CC only from adolescence. The multi-centric Study 2 replicates these tasks with ADHD children (N=154), showing no deficits in learning-based CC, but a lack of improvement under increased cognitive load. Finally, Study 3 explores how digital content affects preschoolers' (N=42) learning-based CC using high-density EEG. Previous studies found negative short-term influence of digital exposure on CC, but cognitive engagement could potentially mediate these effects. Indeed, results reveal that children exposed to cognitively engaging cartoons show enhanced behavioral and neural learning-based CC compared to those watching passive content.

Overall, these findings carry theoretical and practical implications for neuropsychology and education.

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